Lake Ronkonkoma Advisory Board Meeting February 25, 2014

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U.S. Geological Survey

Tonight's presentation

- Who we are: USGS role and monitoring network
- Hydrologic cycle—Long Island aquifer system—wells and water levels
- Pilot groundwater-quality study

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Mission of the U.S. Geological Survey

- The USGS provides the Nation with reliable information about the Earth to:
  - minimize the loss of lives and property from natural disasters
  - manage biological, water, mineral, and energy resources
  - enhance and protect the quality of life
  - contribute to wise economic and physical development

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Role of the U.S. Geological Survey

- Collect hydrologic data using standardized instruments and procedures, which contributes to a nationally consistent data set.

- Create a set of hydrologic data suitable for use in evaluating natural and human-induced changes in Long Island's aquifer system.

- Provide local managers and regulators with data and analysis useful in designing programs to protect aquifers, watersheds, biota, and sensitive aquatic habitats.

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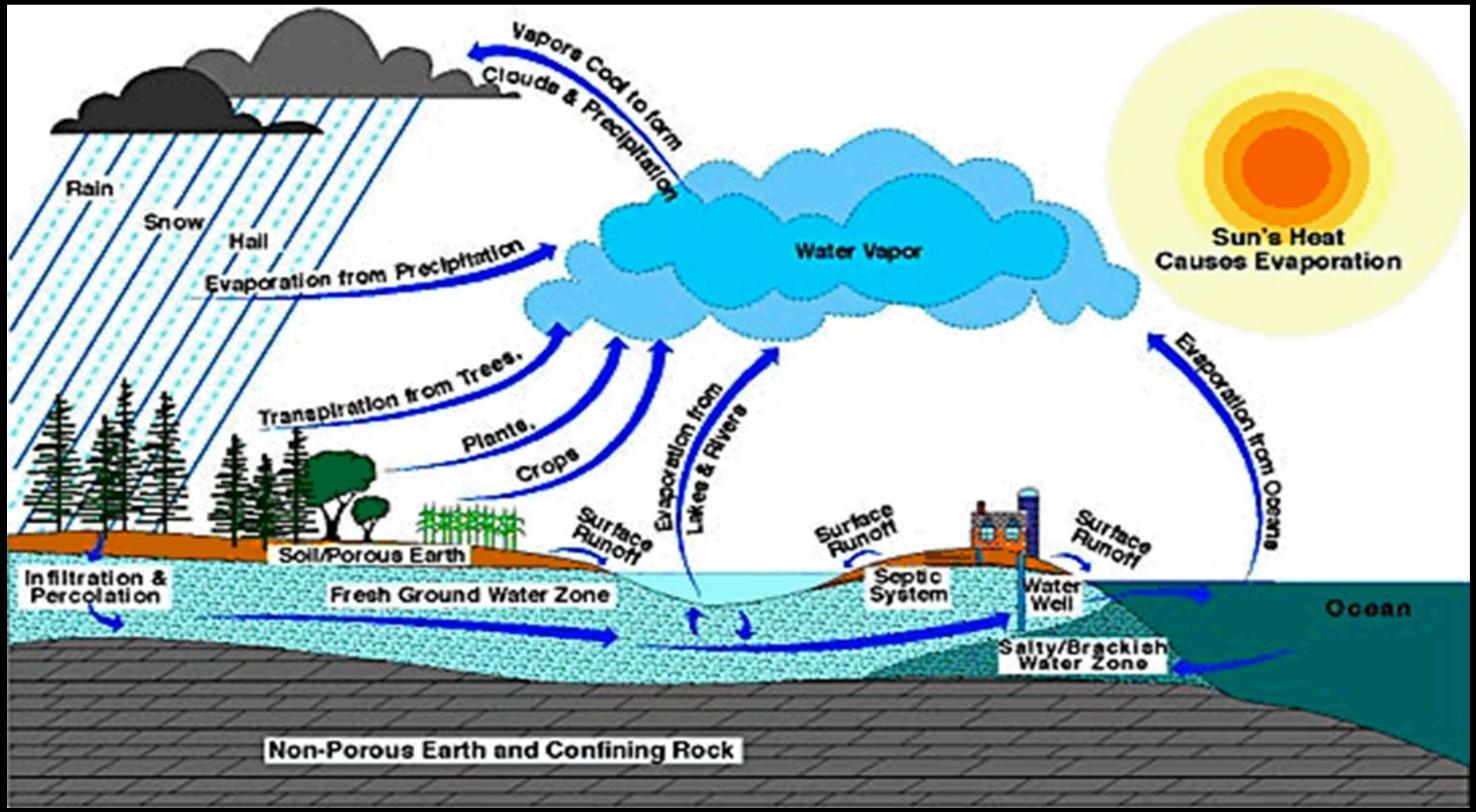
The Hydrologic Cycle



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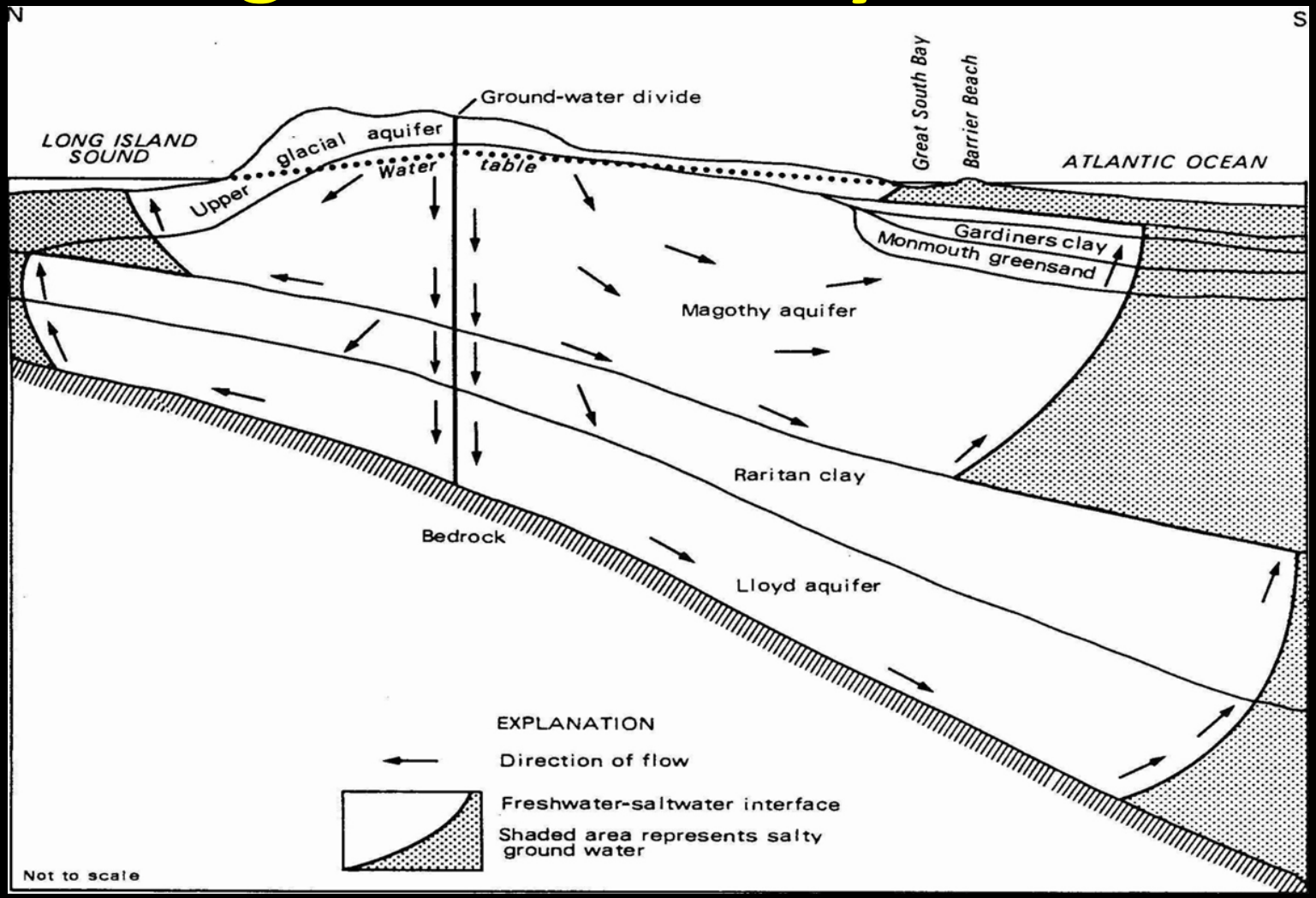
Generalized cross-section of groundwater system



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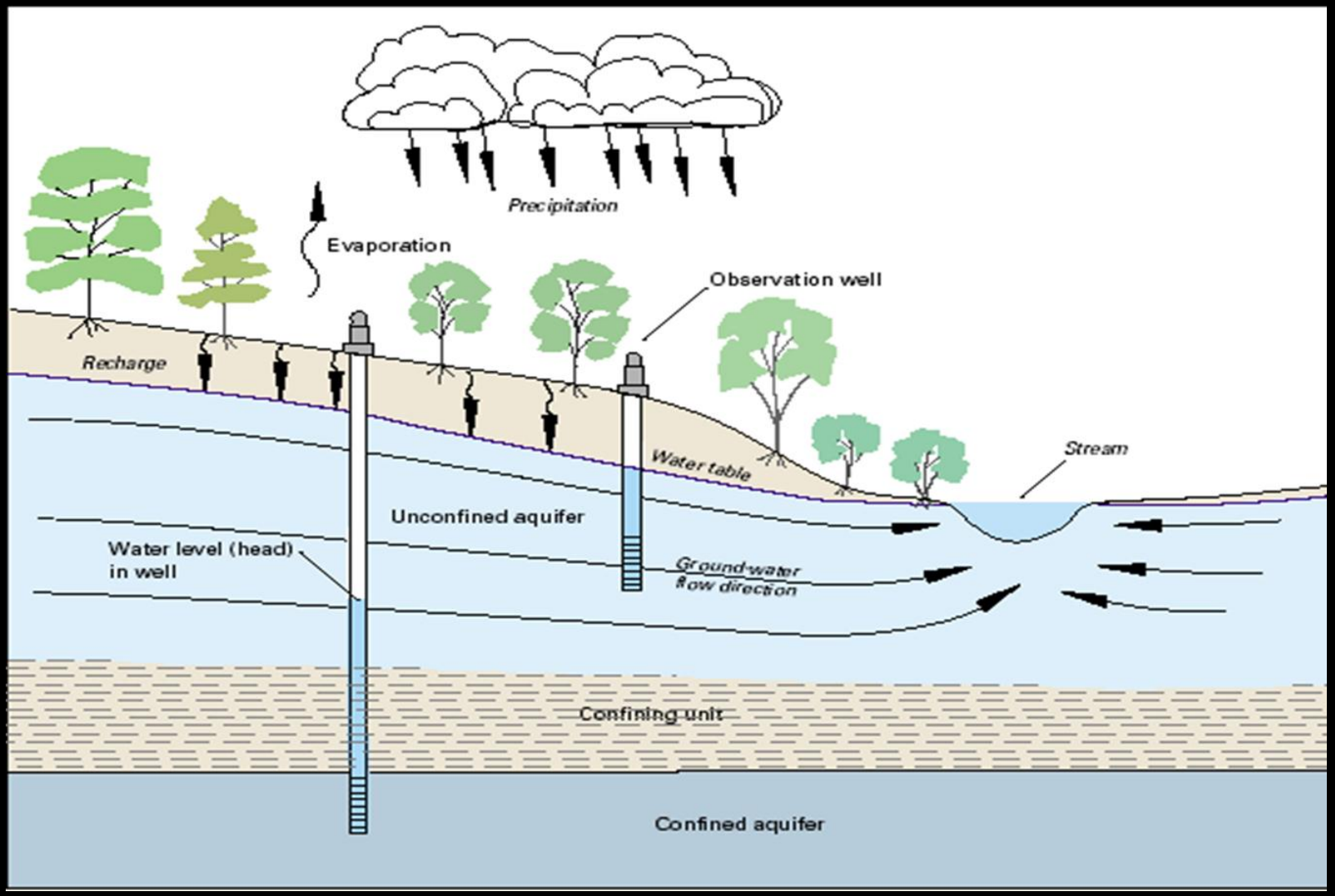
What are wells and water levels



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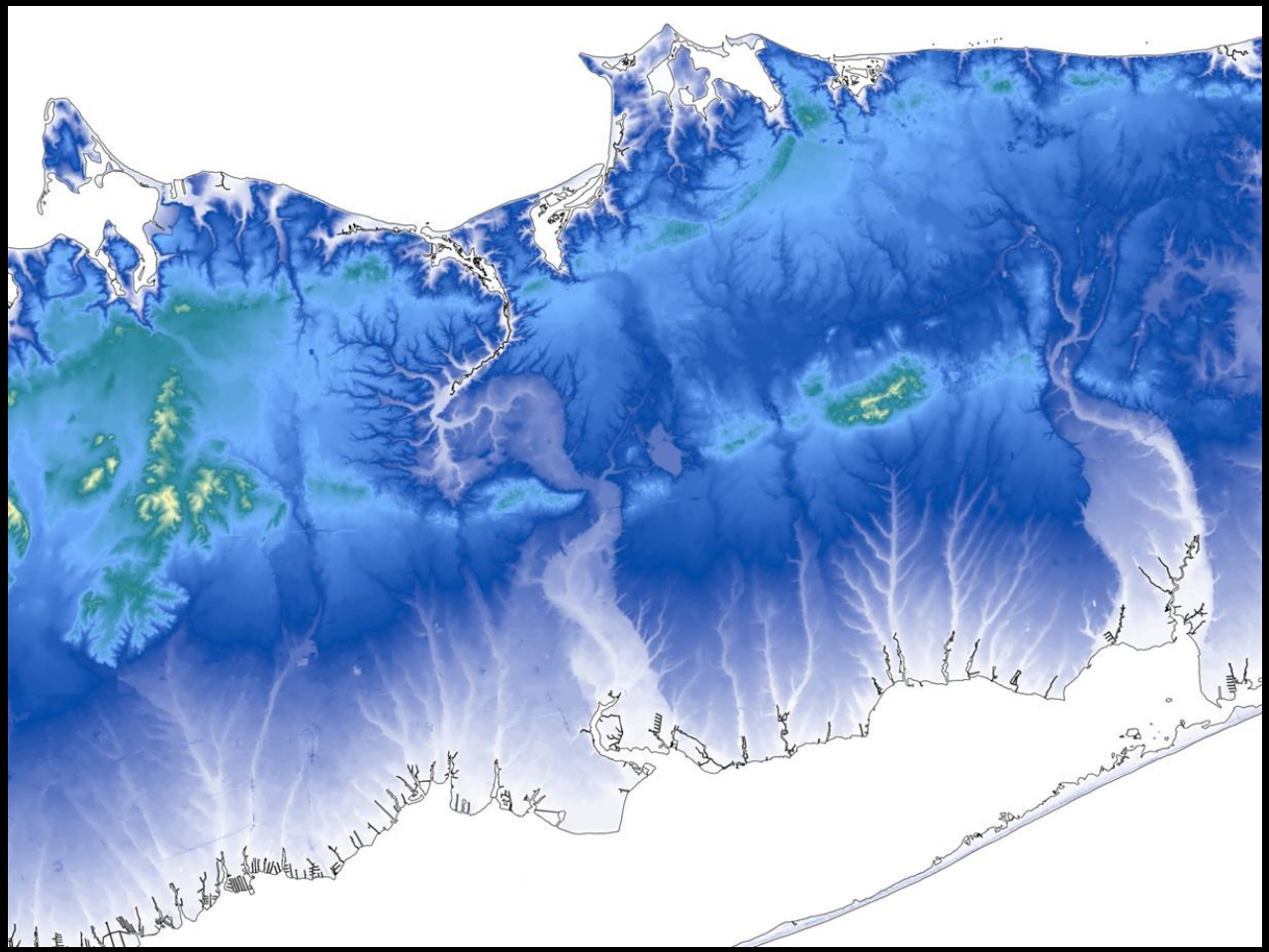
10 Meter Digital Elevation Model



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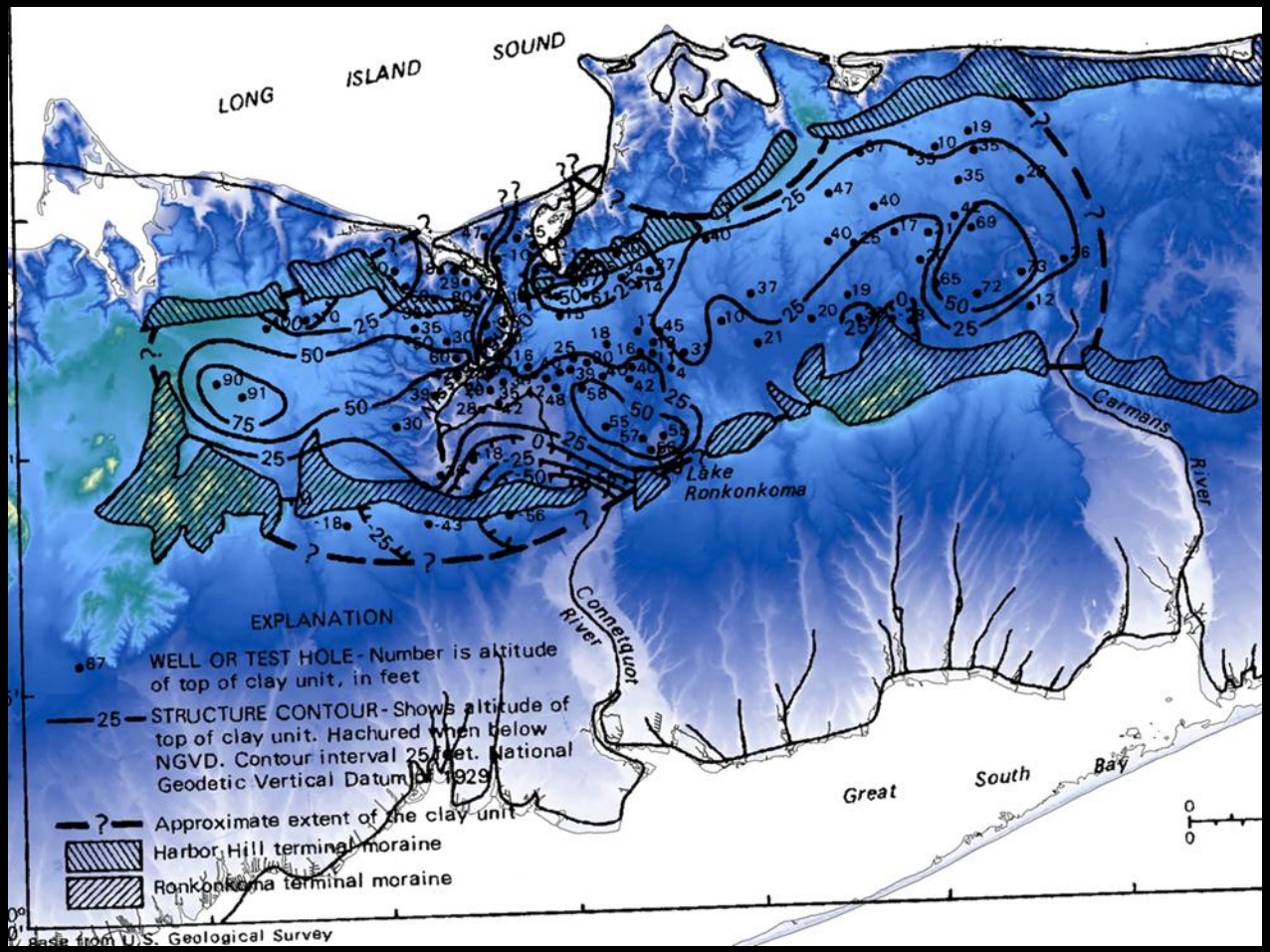
10 Meter Digital Elevation Model with Smithtown Clay



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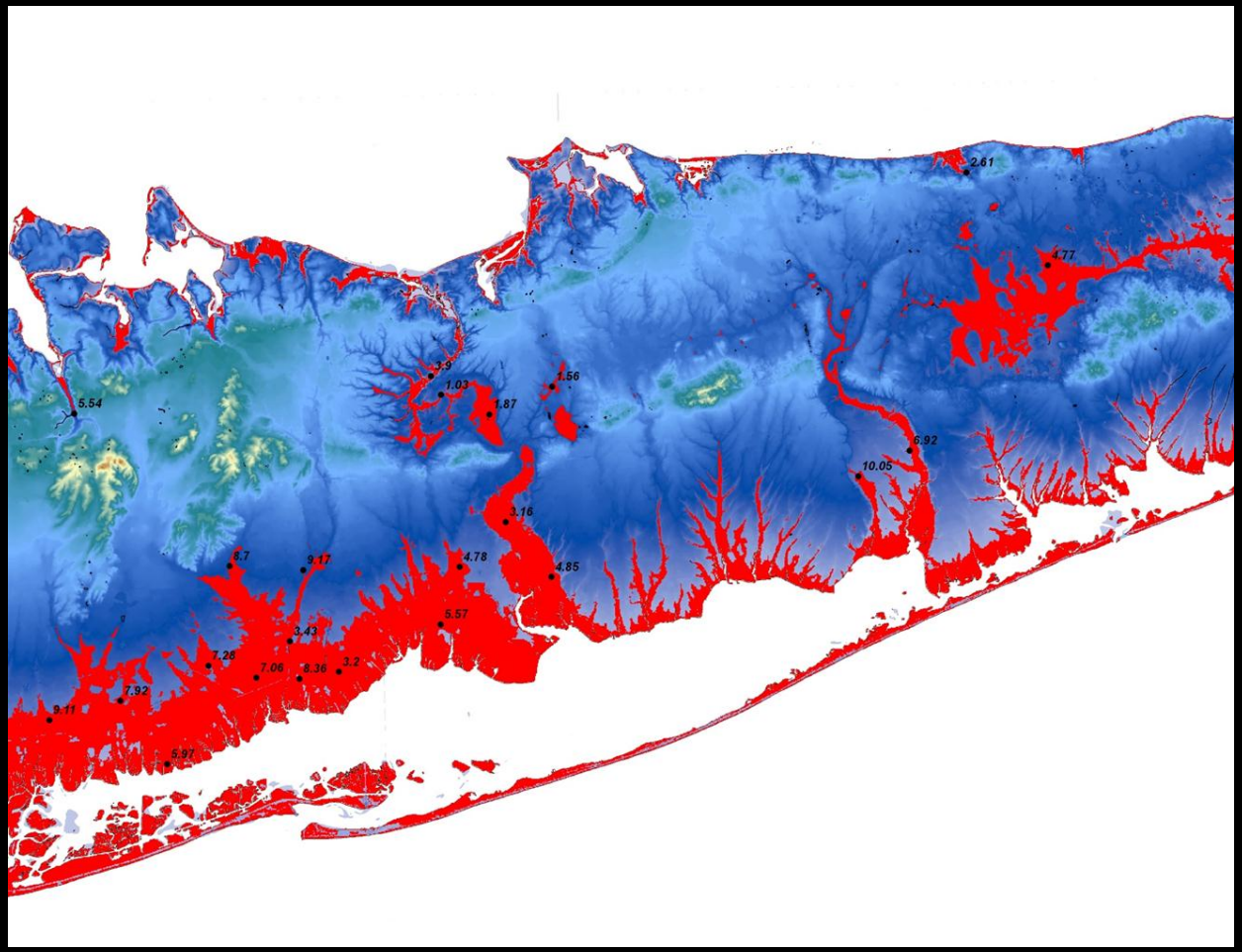
Red areas are <10 feet to water "Provisional"



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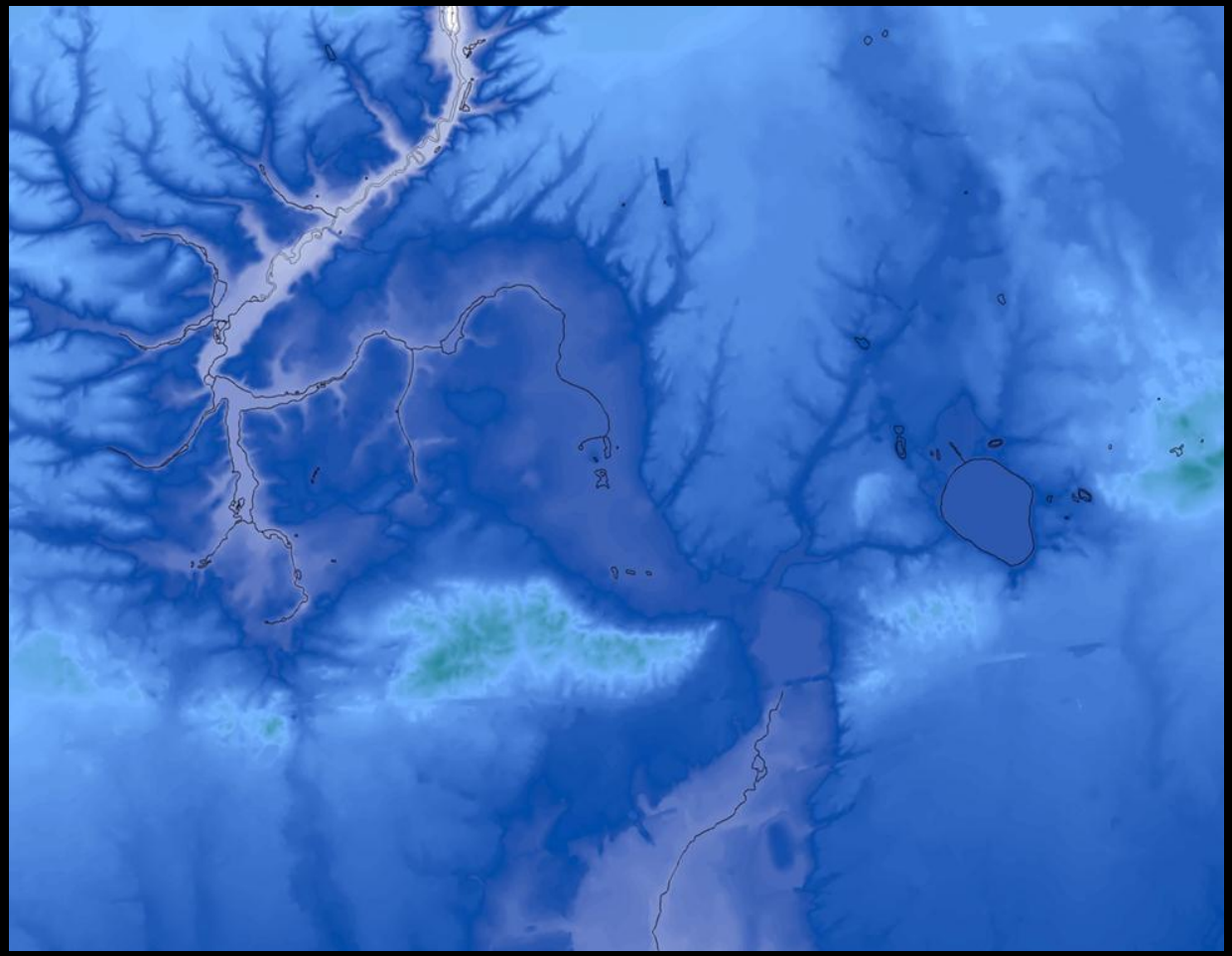

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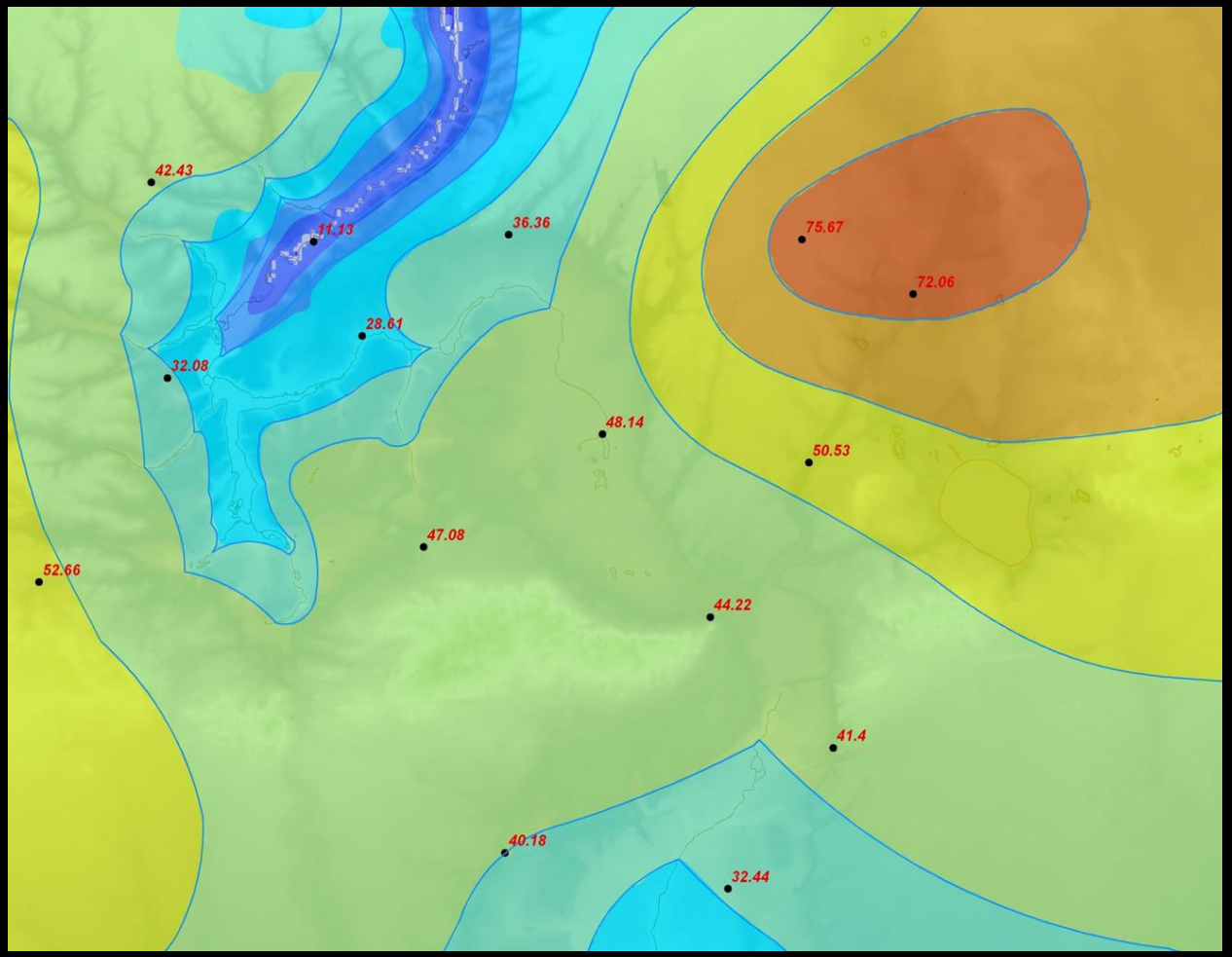
Shallow Groundwater Table



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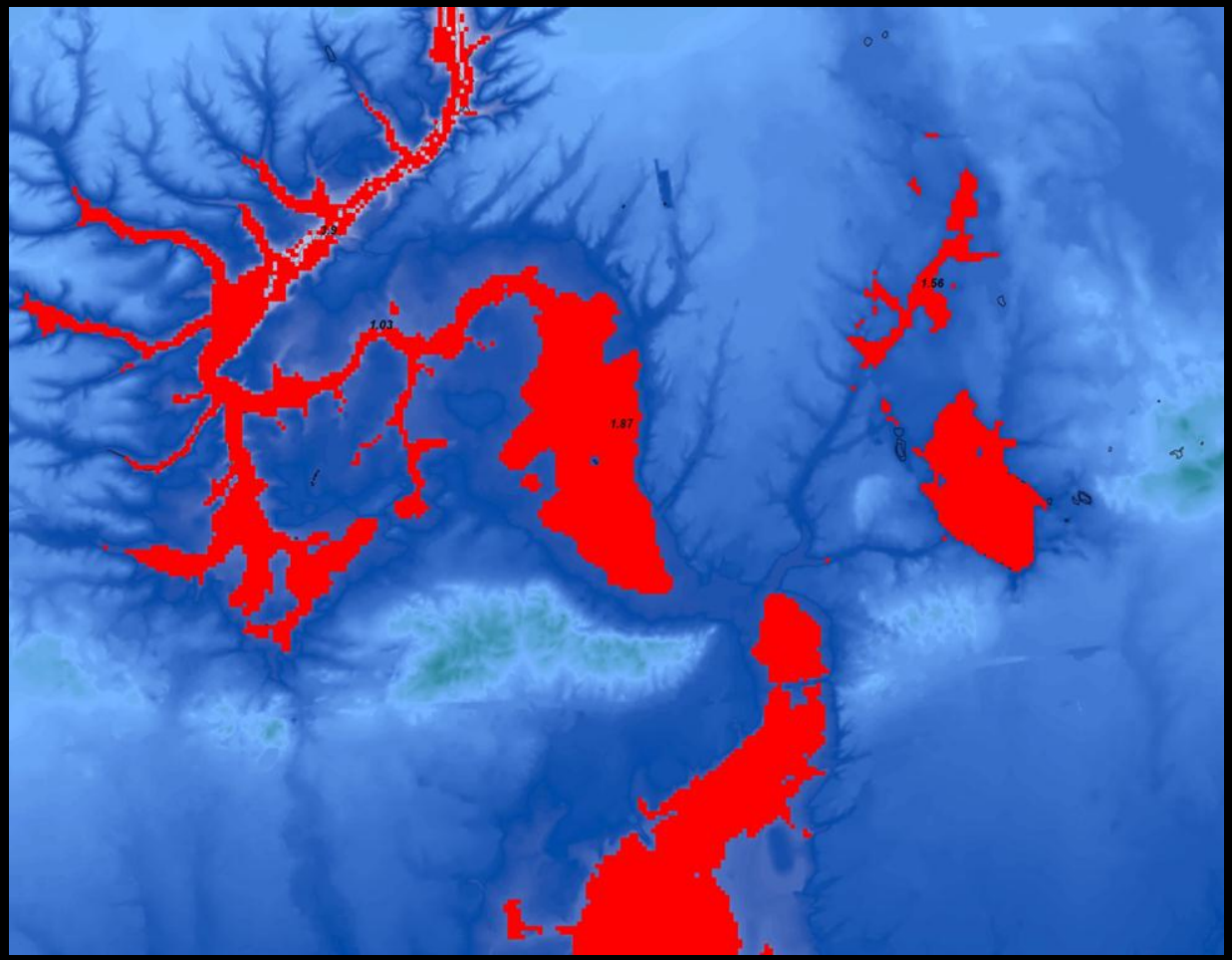

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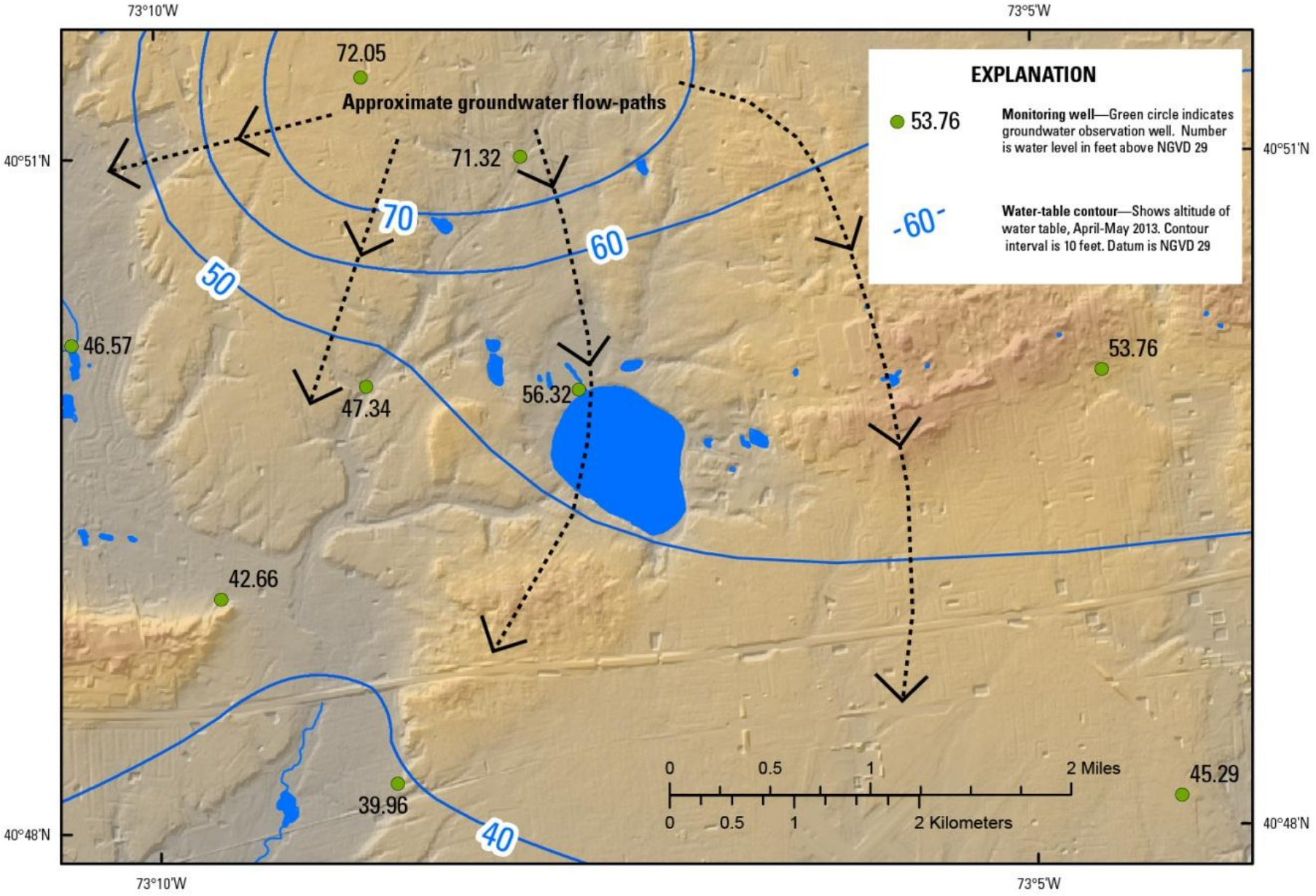
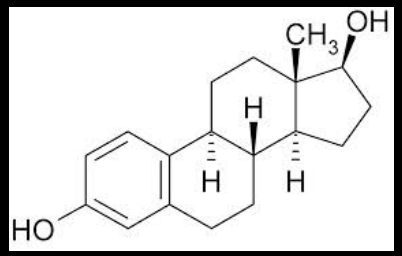
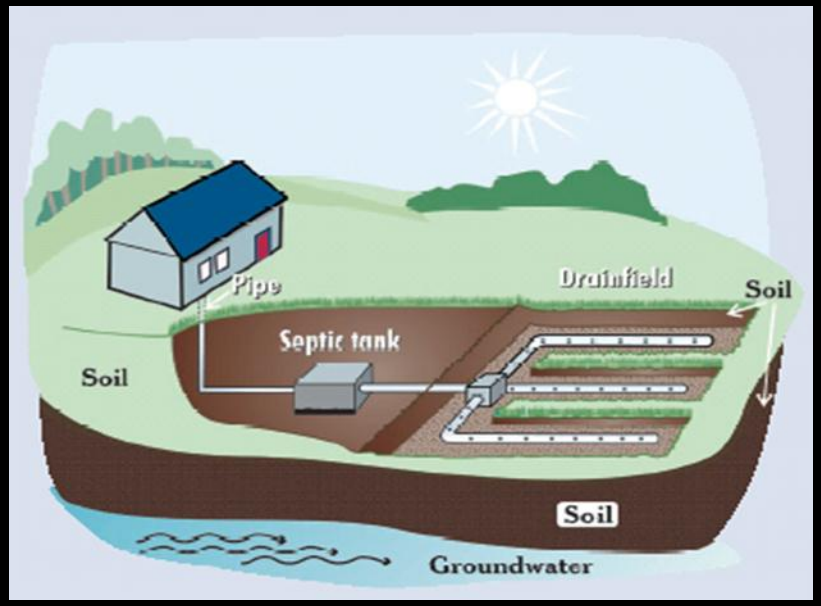
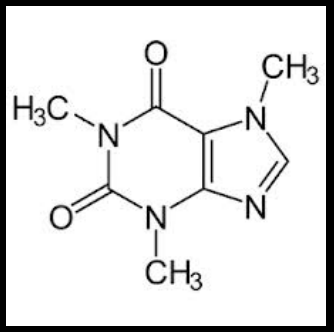


PROVISIONAL DATA -- SUBJECT TO REVIEW

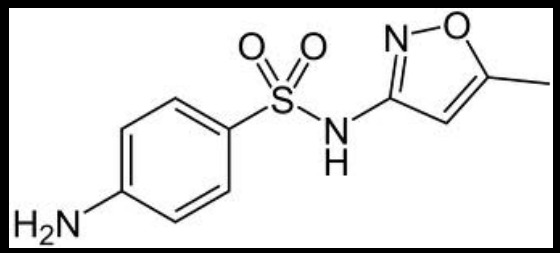


estradiol

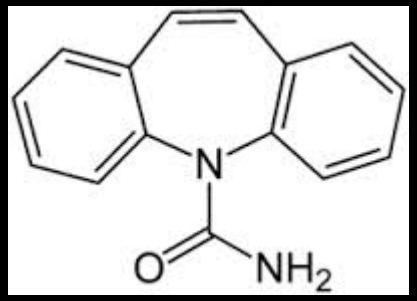




caffeine



sulfamethoxazole



carbamazepine

EMERGING CONTAMINANTS

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Groundwater Transport on Long Island

- Sandy soil, relatively high hydraulic conductivity
- Chemical structure determines transportability through aquifer

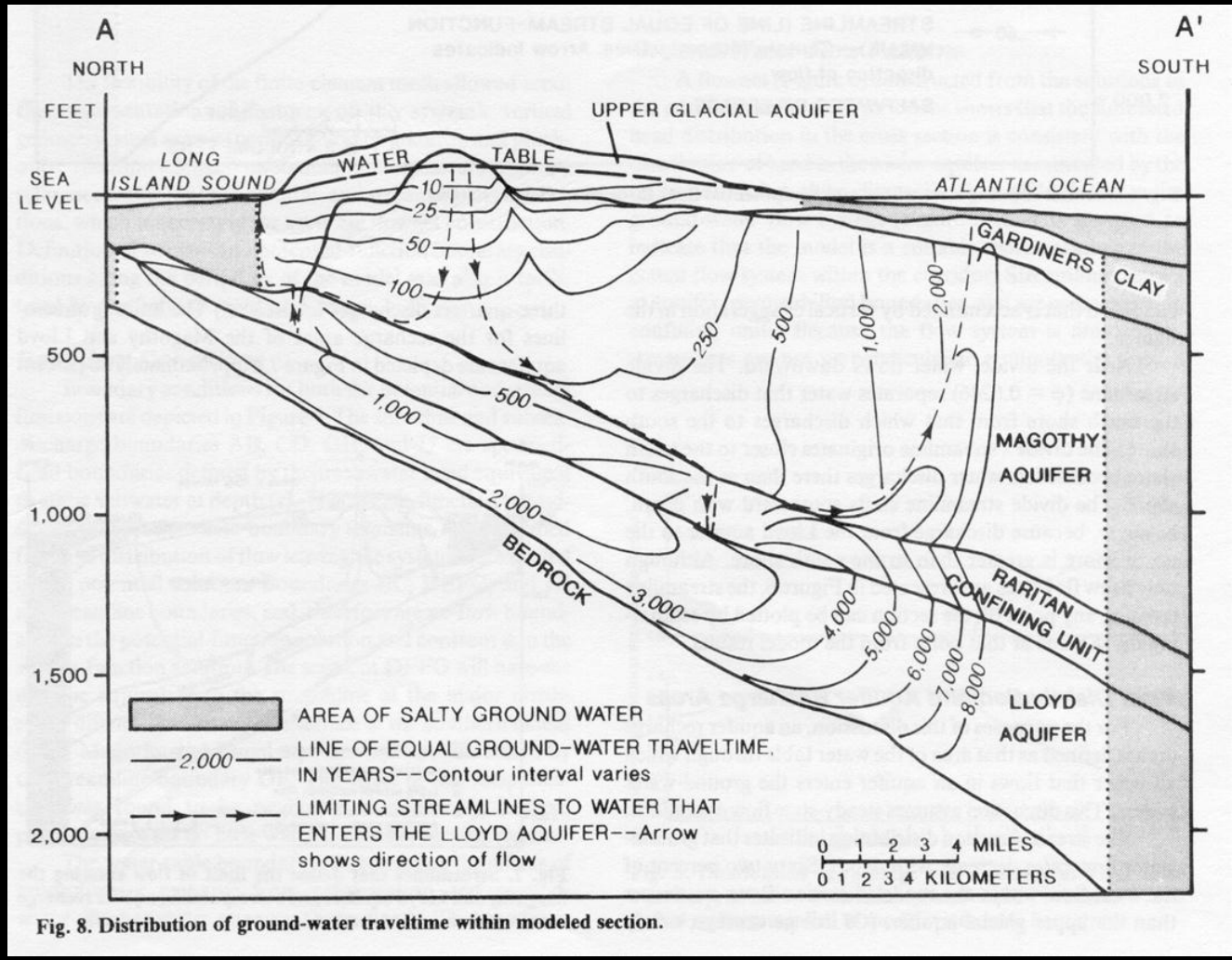

Fig. 8. Distribution of ground-water traveltime within modeled section.

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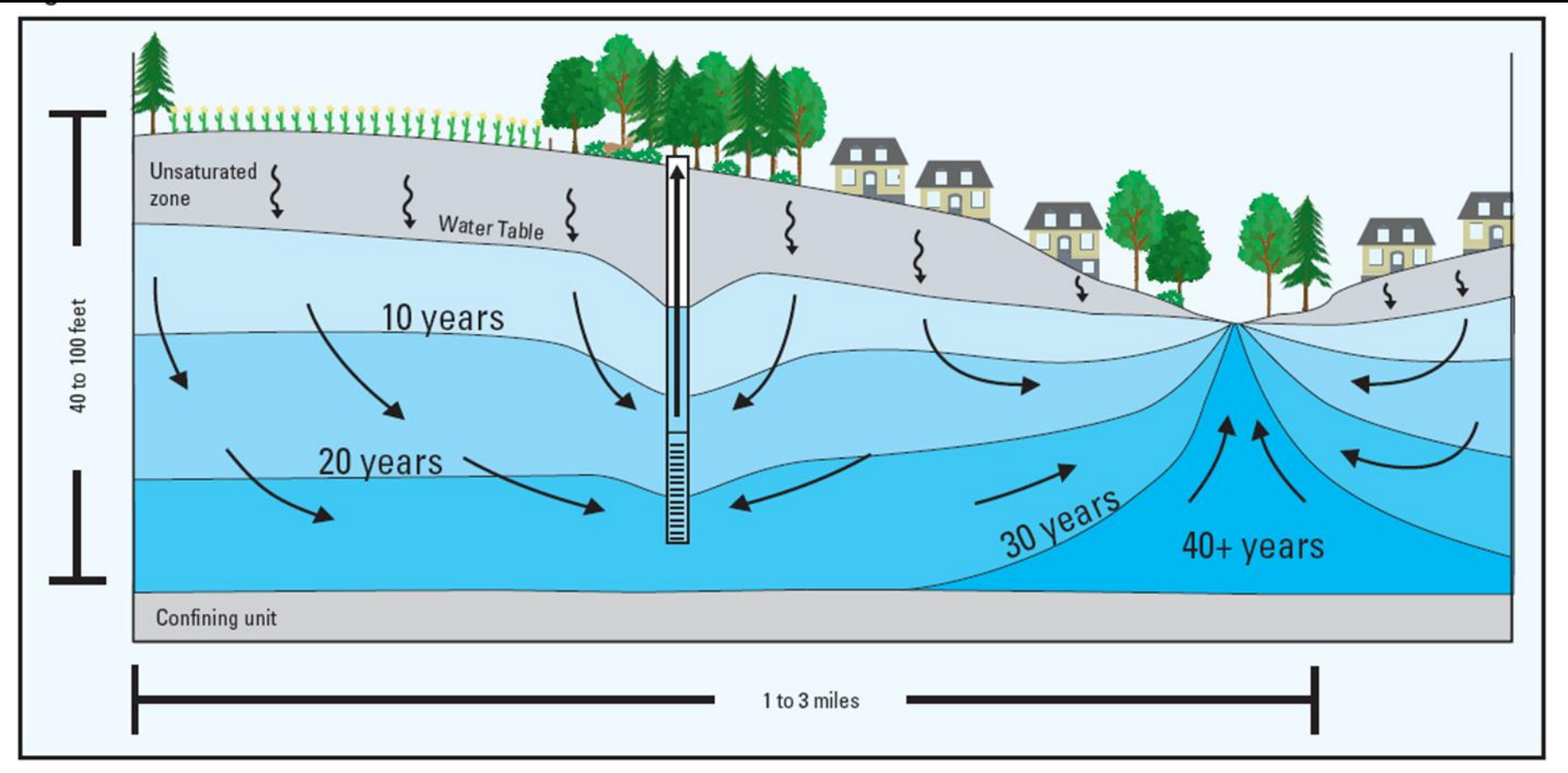
Groundwater Contaminants: from source to stream



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Emerging contaminants in Suffolk County groundwater

- Data collected between 2002-2005 from upper glacial and shallow Magothy aquifer wells
- Detections of a number of wastewater-indicator compounds at low levels
- Compounds also detected in lakes and stream throughout the country with sources linked to
  - wastewater treatment facilities
  - combined sewer overflows
  - groundwater discharge

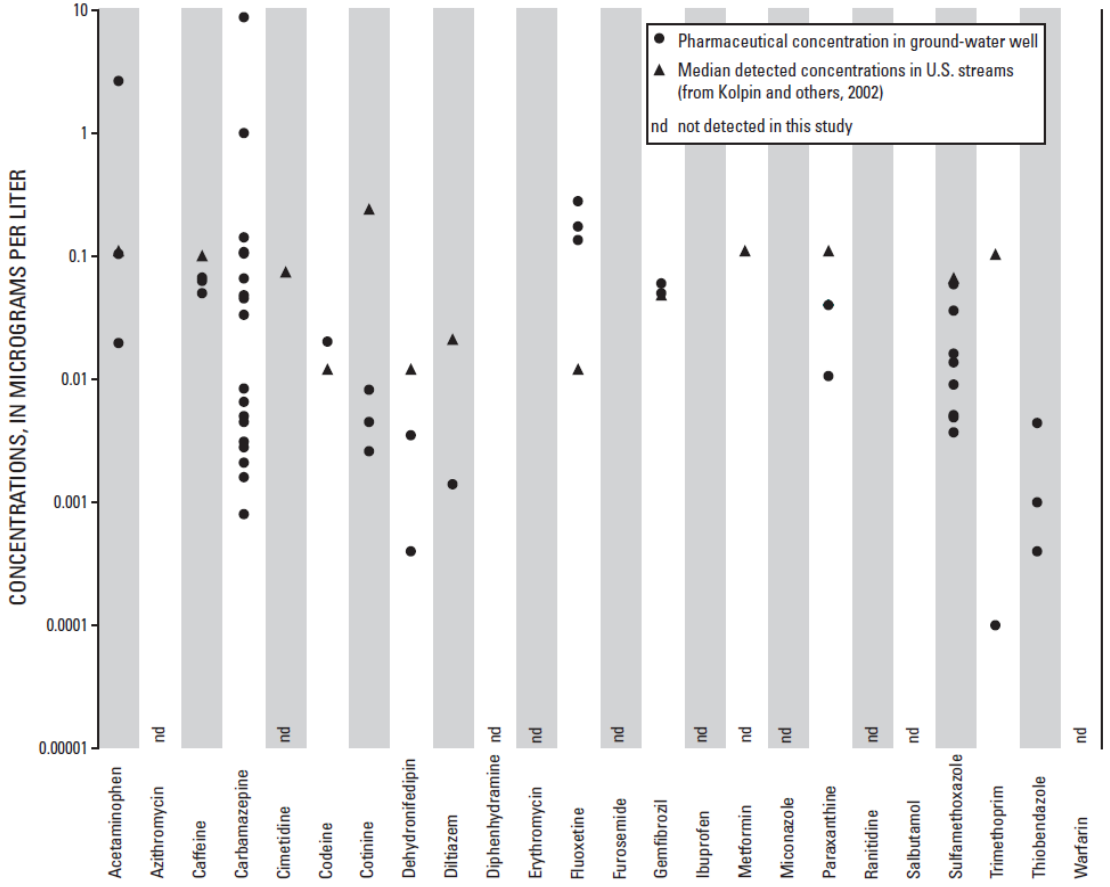

Figure 2. Concentrations of pharmaceuticals detected in 61 wells in Suffolk County, Long Island, N.Y. (Locations of wells are shown in figure 1).

Benotti and others, 2006, USGS Open-File Report 2006–1297

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Interpreting Wastewater-derived Emerging Contaminants in the Environment

- Certain wastewater indicator compounds resist degradation in on-site septic systems and wastewater treatment facilities
- Their presence can be correlated to nutrient levels in the shallow groundwater near sources of wastewater
- Affects on water quality in Lake Ronkonkoma is untested—additional samples of groundwater and surface water would provide useful information towards development of TMDLs for the Lake

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Pilot groundwater-quality study at Lake Ronkonkoma

- Snap-shot of potential wastewater influences to Lake Ronkonkoma
- Sampled in summer 2013 and winter 2014
- Shallow water-table samples collected using drive-point piezometer
- Analyses included
  - Nutrients (nitrogen, phosphorus)
  - Wastewater indicators (~60 compounds)
  - Pharmaceuticals (~75 compounds)
  - Fecal Indicator Bacteria (Total coliforms and *E.* coli)
  - Hormones associated with wastewater [archived]
- Data comparable with those from other studies on LI

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Pilot groundwater-quality study at Lake Ronkonkoma

- Groundwater collected on the north and northwest shores of the lake
- Lake Ronkonkoma Groundwater locations
- Groundwater levels
  - LRGW01: 5 feet below surface
  - LRGW02: 9 feet below surface

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Pilot groundwater-quality study at Lake Ronkonkoma

2013 PROVISIONAL DATA -- SUBJECT TO REVIEW

- LRGW01
  - fluconazole; antifungal
  - methyl-1h benzotriazole; deicer, industrial solvent, drug precursor
- LRGW02
  - carbamezapine; an anti-seizure drug
  - meprobamate; an antianxiety drug
- Concentrations of wastewater compounds in the parts-per-trillion to parts-per-billion range

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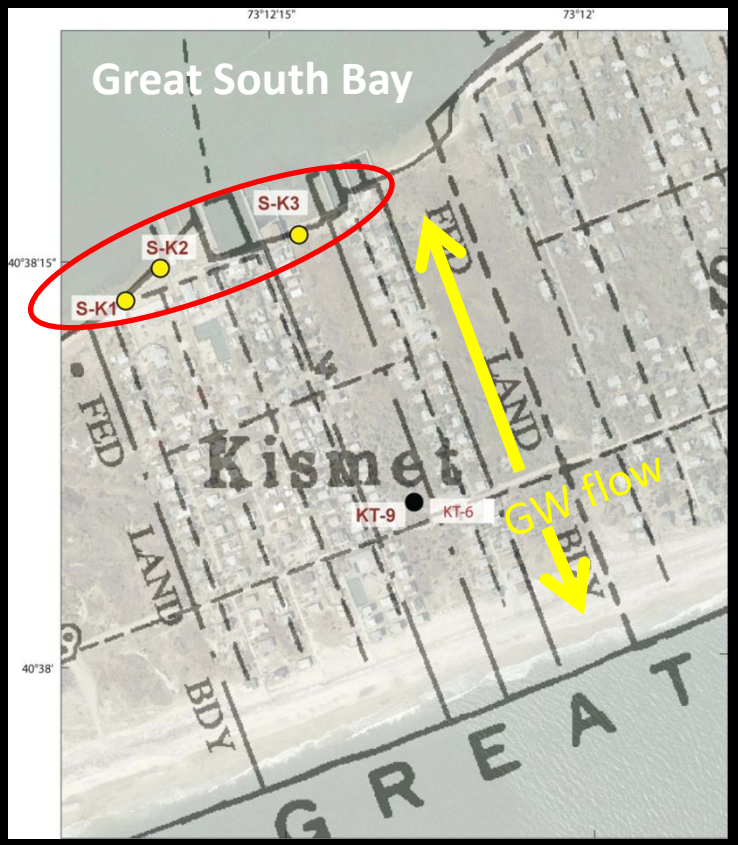
Case Study: Fire Island National Seashore

- Are septic systems contributing wastewater compounds and nutrients to the Great South Bay?
- Septic systems are an important source of nutrients to Great South Bay (Schubert, 2009)
- Analogous to Lake Ronkonkoma in source and transport



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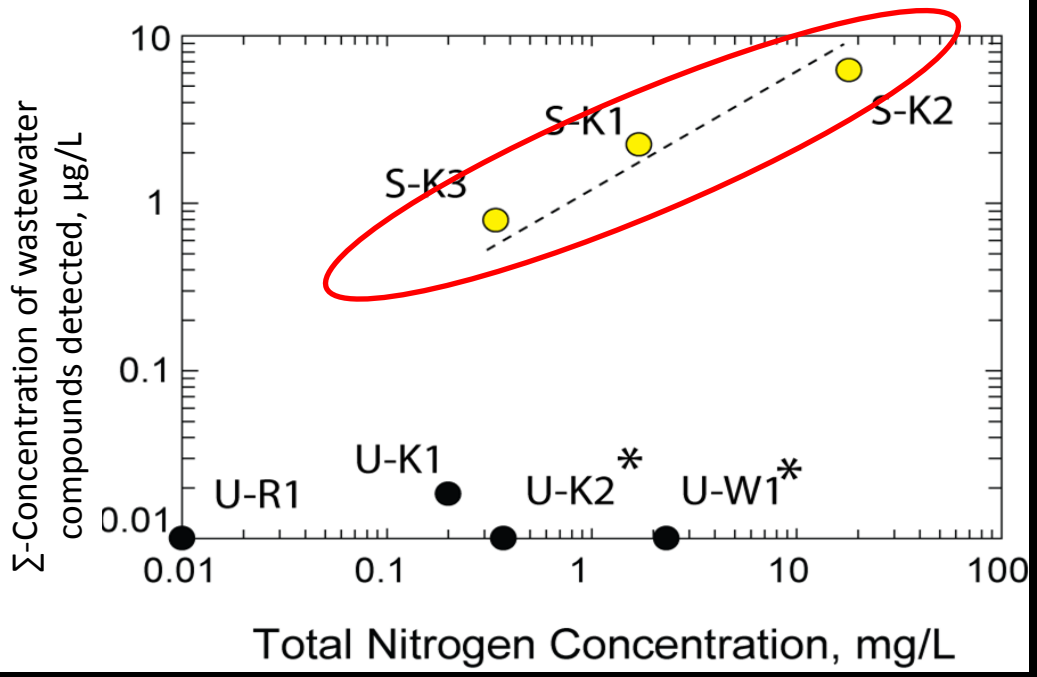
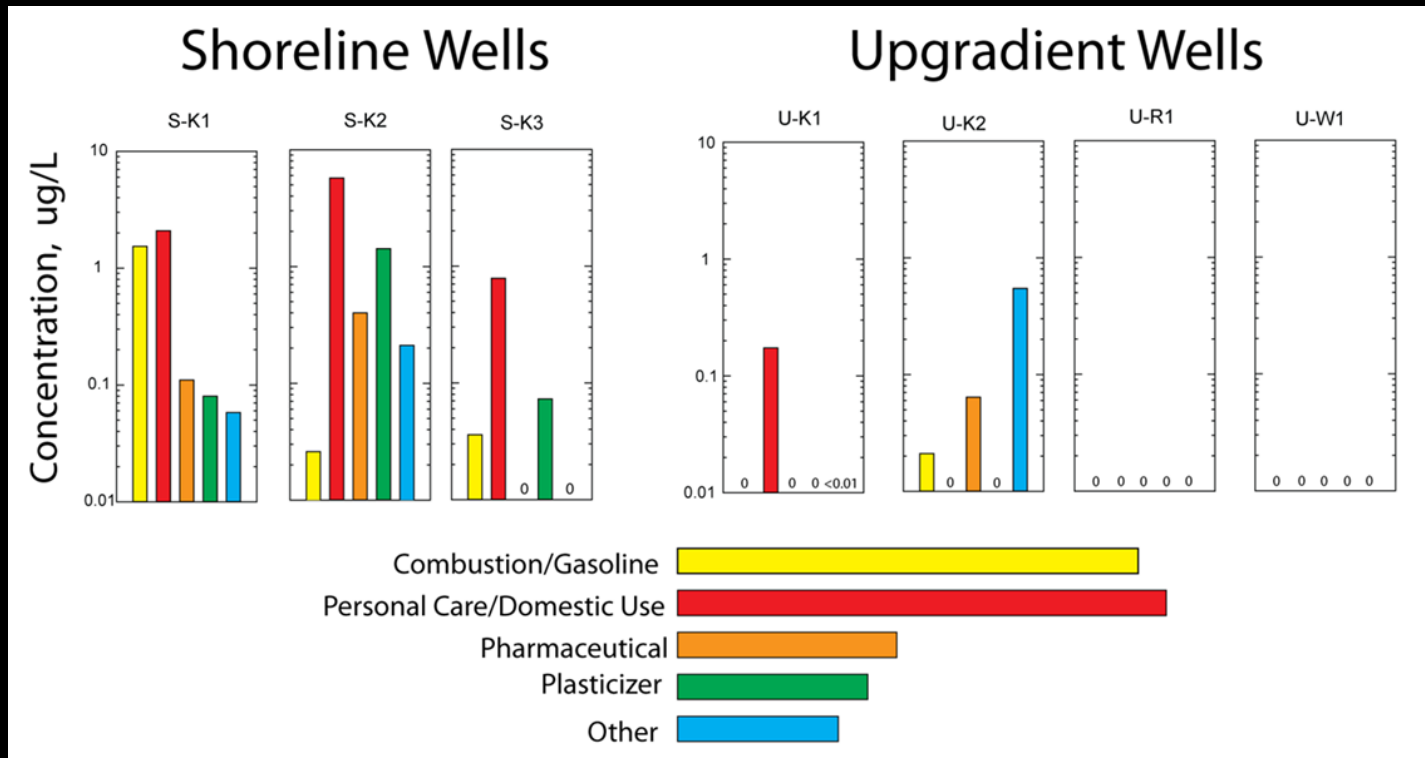


Case Study: Fire Island National Seashore



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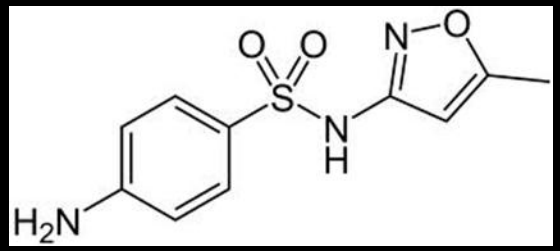
Potential Implications of Wastewater-impacted Seepage

- Prolonged nutrient loading can result in eutrophic conditions
- Pathogenic bacteria from human (as well as wildlife) waste will continue to limit lake access for recreation
- Endocrine-disrupting compounds (hormones and hormone-mimicking compounds) could skew fish gender ratios (Duffy and McElroy, 2008)

Potential Implications of Wastewater-impacted Seepage

- Sulfamethoxazole (an antibiotic)
  - Detected in a number of groundwater wells (Benotti and others, 2006)
  - Shown to reduce rates of denitrification in groundwater (Underwood and others, 2011)
  - Can lead to antibiotic resistance in soil and sediment



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Additional data needed

- Detailed groundwater flow modeling
- Real-time lake level monitoring
- Lake water chemistry
- Groundwater sampling at additional locations along coast

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Contact Info

Any Questions?

http://ny.water.usgs.gov/

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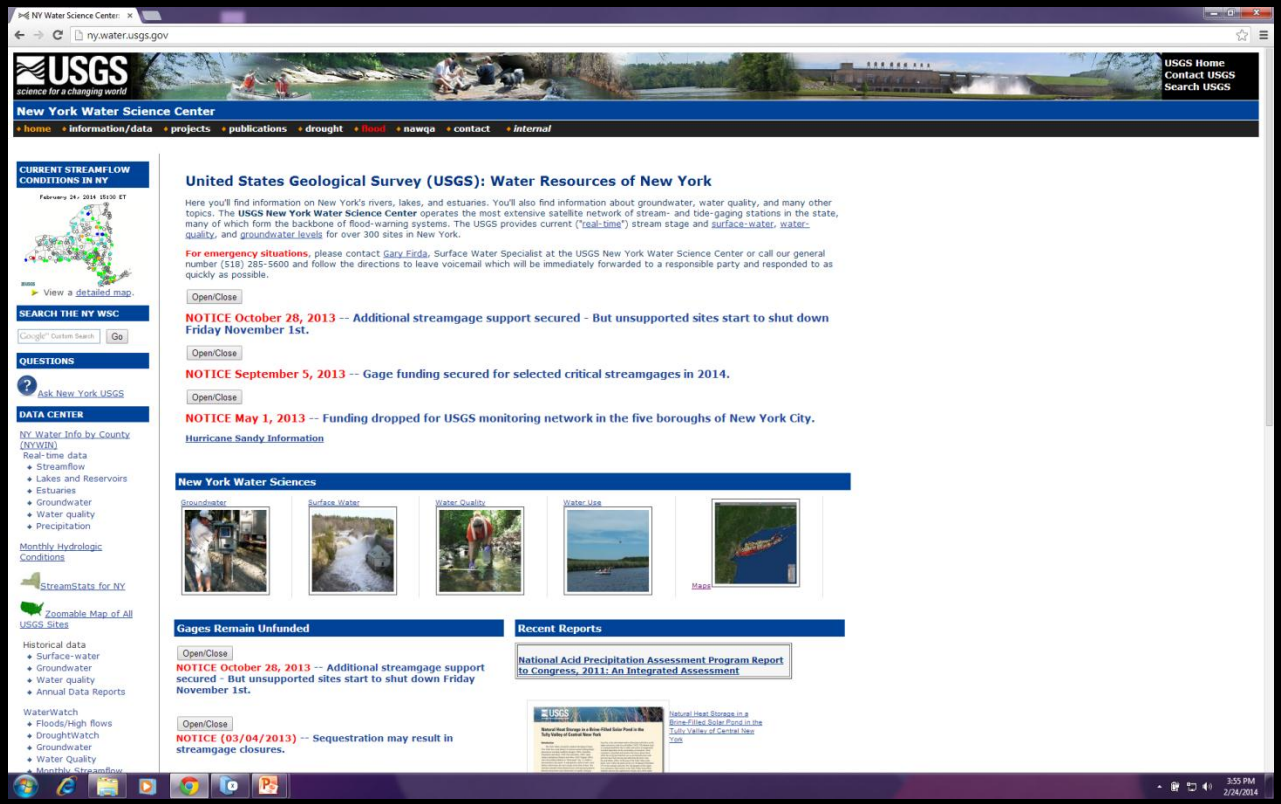

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